EXPANDED SITE INVESTIGATION
DEAD CREEK PROJECT SITES
AT CAHOKIA/SAUGET, ILLINOIS
FINAL REPORT
VOLUME 2 OF 2

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Prepared for:

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SITE O - SAUGET WASTE WATER TREATMENT PLANT

Site Description

Site O is the Sauget Waste Water Treatment Plant and related property, located on Mobile Avenue in Sauget, Illinois. The property covers approximately 45 acres in a heavily industrialized area. The site consists of a series of four inactive sludge dewatering lagoons and a separate area of contamination. The former sludge lagoons cover approximately 20 acres to the south of the treatment plant buildings, and the identified contaminated area (3 acres) is located immediately west of the Sauget Waste Water Treatment Plant on the northwest corner of the property.

Site History and Previous Investigations

The Sauget Treatment Plant has been in operation in some form since approximately 1952. The plant primarily treats effluent from area industries, but also provides treatment for the entire Village of Sauget. Approximately ten million gallons per day (MGD) of waste water is treated at this facility, of which over 95 percent is from industrial sources. Area industries served by the Sauget Treatment Plant include Monsanto Chemical, Cerro Copper, Sterling Steel Foundry, Amax Zinc, Rogers Cartage, Edwin Cooper, and Midwest Rubber. Effluent from the treatment plant is directed to a National Pollutant Discharge Elimination System (NPDES) permitted discharge point in the Mississippi River.

The treatment plant has a long history of NPDES permit violations, for the most part due to the chemical quality of the plant effluent. Mercury, PCBs, and organic solvents have been detected at concentrations exceeding permit limits on several occasions. A USEPA study conducted in 1982 concluded that the treatment plant waste water contributed a substantial volume of priority, toxic pollutants annually to the Mississippi River. Since operations began, the plant has undergone several modifications and upgrades, increasing both

capacity and effluent quality.

According to a Notification of Hazardous Waste Site Form submitted to USEPA in 1981, the former lagoons were used for disposal of clarifier sludges from 1965 to approximately 1978. The lagoons were designed to drain liquid from the sludge. The lagoons were not artificially lined, and were apparently excavated into the Henry Formation Sand. Initially, the sludge was not treated in any way after being placed in the lagoons. After an unknown period of time, lime was used for neutralization.

In 1982, IEPA personnel collected a sample of filter cake sludge from the treatment plant, which provides an indication of the chemical quality of sludges placed in the lagoons. Analysis of this sample showed several organic contaminants, including chlorinated benzenes, xylene, and aliphatic hydrocarbons, at concentrations ranging from 120 to 820 ppm. The lagoons are presently covered with two feet of clay and have been vegetated. Sludges from the Sauget Treatment Plant, which is still in operation, are presently taken to two IEPA-permitted landfills in the St. Louis Metro-East area.

Extensive construction/excavation has been done since 1981 in the area surrounding the Sauget Treatment Plant. The new American Bottoms Regional Treatment Plant, completed in 1985 but not on line as yet, is located immediately south of the former sludge lagoons. Several problems involving chemical wastes were encountered during excavation work for the construction of this facility. In 1984, workers uncovered a black, tar-like substance with a strong solvent odor while digging a trench for sewer and water lines to the new treatment plant. Although file information is sketchy concerning the exact location of this incident, it is thought to be in the southern portion of Lagoons 3 and 4 (Figure 0-1). Two samples of the waste material were collected by Envirodyne Engineers, Inc. (EEI) of St. Louis, and a limited organic analysis was run. Both samples showed the presence of PCBs (477 to 653 ppm), phenol (0.28 to 12.0 ppm), and oil and grease (29 to 35 percent). Benzene was also detected at

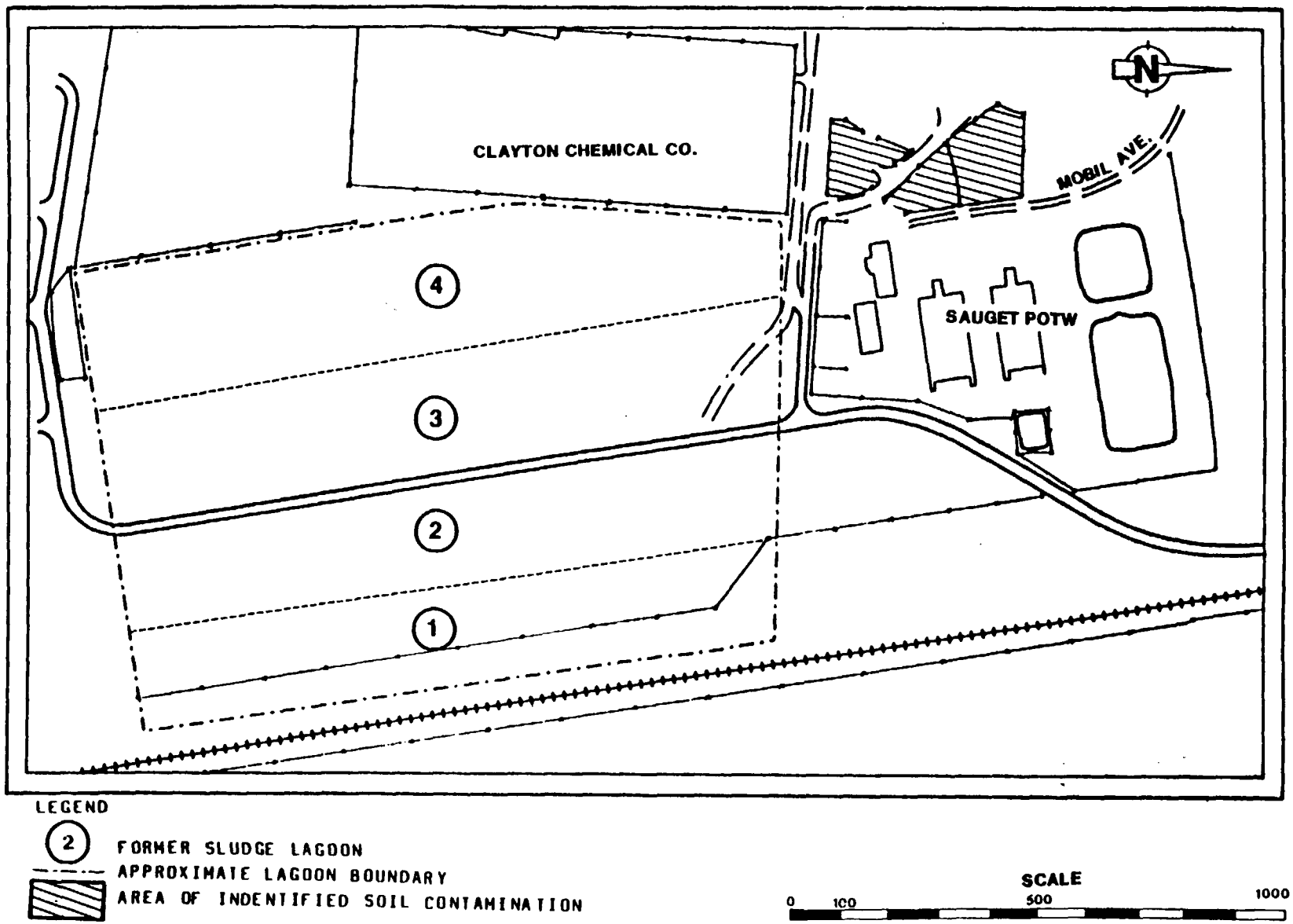


FIGURE 0-1
FORMER SLUDGE LAGOONS AND CONTAMINATED SOIL AREAS AT SITE 0

trace levels (1 ppb) in both samples.

Several additional locations have reportedly been sampled by EEI as a result of uncovering waste materials during excavation activities around the Sauget Treatment Plant. However, attempts to gather information concerning specific sample locations and analytical data have been of limited success. Chemical data for two soil samples collected from excavated soil piles in the area of the former sludge lagoons was acquired. These results are shown in Table O-1. Both samples show high levels of several chlorinated organics and other priority pollutants. Values were listed for total PCBs, however, the PCB results could not be verified by the laboratory. Although limited data has been acquired, available data indicates that the former sludge lagoon area likely contains widespread organic and inorganic contamination.

In 1983, IEPA identified another highly contaminated area at Site O. This area is located directly west of the existing treatment plant and approximately 200 feet north of the Clayton Chemical Company property (Figure O-1). IEPA and EEI personnel conducted a cooperative sampling effort in this area during February and March of 1983. A total of 33 surface and subsurface soil samples were collected and analyzed for PCBs and TCDD (samples collected in March were analyzed for TCDD only). Analytical results for these samples are shown in Tables O-2 and O-3. The results of initial sampling done in February show relatively high levels of PCBs in all samples, including those taken to a depth of 14 inches. Sample location 5, in the area of a proposed effluent-pump station, was the only location where TCDD was detected in the initial sampling. Based on the results from samples collected in February, it was determined that further sampling would be necessary. In March, 1983, 21 soil samples were collected from 10 locations in the area of the initial sampling. Depths of these samples ranged from 0 to 28 inches. Sample number 14 was a composite of several soil piles, and samples 10A and 10B were spiked control samples. The results of these samples indicate significant TCDD contamination throughout the area. Sample locations

TABLE O-1: IDENTIFIED ORGANIC COMPOUNDS IN SAMPLES FROM TRENCH EXCAVATION AT SITE O (COLLECTED JULY 20, 1984 BY RUSSELL AND AXON, INC.)[a]

	SAMPLE LOCATIONS		
PARAMETERS	SAMPLE 1	SAMPLE 2	BLANK
2,4-Dichlorophenol	50.1		
Pentachlorophenol	3,600	159	
2,4,6-Trichlorophenol	39.3		
Crysene	123	2.2	
Benzo-k-Fluoranthene	15.9	0.45	
Bis(2-Ethylhexyl) Phthalate	10.9		0.098
1,2-Chlorobenzene		12.2	
1,4-Dichlorobenzene		8.01	
Di-Butyl Phthalate		5.06	0.1
Phenanthrene	100	1.6	
Pyrene	102	2.1	
1,2,4-Trichlorobenzene	65.3	1.6	
PCBs	*	*	
Benzo(a)Pyrene	4.2	1.0	

NOTE: All results in ppm.
Blanks indicate compound not detected.
* Identified, but values cannot be verified.
a Analysis performed by Envirodyne Engineers, Inc. (EEI), St. Louis, MO.

TABLE 02: ANALYTICAL RESULTS FOR SOIL SAMPLES AT SITE 0 (SPLIT SAMPLES COLLECTED FEBRUARY 19, 1983 BY IEPA AND EEI).

	PARAMETERS				
SAMPLE NO. (Depth)	PCB - IEPA	PCB - EEI	TCDD - IEPA[a]	TCDD - EEI	Comment
1 (0" - F")	1,500	3,690			
2A (0"- F")	7,600	5,350			
2B (7" - 13")	390	716			
3A (0" - 7")	9,100	137,250			
3B (7" - 13")	40	28			
4A (0" - 6")	20,000	21,020			
4A (0" - 6")	-	15,510			Duplicate-EEI
4B (6" - 13")	54,000	149,600			
5A (0" - 6")	32,000	112,930	18	28	
5A (0" - 6")	-	-	17	-	Duplicate-IEPA
5B (6" - 14")	20,000	12,050	4.1	5.1	
6 (0" - 8")	120	90			

NOTE: All results in ng/g (ppb).
Blanks indicate below detection limits.
- Indicates parameter not analyzed.
a Hazelton Raltech, Inc. performed TCDD analysis for IEPA.

TABLE O-3: ANALYTICAL RESULTS FOR SOIL SAMPLES AT SITE O. (SPLIT SAMPLES COLLECTED MARCH 12, 1983 BY IEPA AND EEI)

	PARAMETERS		
SAMPLE NO. (Depth)	TCDD - IEPA[a]	TCDD - EEI	COMMENTS
7A (0"- 6")			
7B (8" - 16")	1.8	44	
8A (0" - 6")	77	Interferences	
8B (6" - 12)	*	19	
8C (13" - 18")		37	
8D (18" - 25")		56	Duplicate
8D (18" - 25")			
9A (0" - 6")	1.3		
9B (6" - 12")	*		
9C (14" - 21")			
9D (22" - 28")	0.92		Control Sample
10A	12		Control Sample
10B	*	13	
11A (0" - 6")			
11B (G" - 18")	*		
12 (10" - 19")	*		
13A (0" - 7")			
13B (7" - 18")	13	13	
14 (0" - 6")	25	170	Composite of soil samples
15 (0" - 16")			
16 (0" - 18")			

NOTE: All results in ng/g (ppb).
Blanks indicate below detection limits.
* Sample not collected by IEPA.
a Hazelton Raltech, Inc. performed TCDD analysis for IEPA.

8, 15 and 16, all near the proposed pump station, showed the highest concentrations of TCDD (ranging from 13 to 170 ppb).

Based on the results of the sampling done in February and March, 1983, USEPA estimated that 2800 cubic yards of contaminated soil existed at the site. Further sampling was proposed by USEPA to determine the extent of PCB and dioxin contamination, and plans were prepared by Russell and Axon, Inc., a contractor for the Village of Sauget, for a temporary containment facility for the contaminated soil. The USEPA, IEPA, the Village of Sauget, and contractors representing the village were involved in discussions concerning possible remedial alternatives for the contaminated soil. However, no remedial actions have been implemented to date. Presently, a fence encloses the contaminated area, and the surface has been covered with gravel.

The source of the PCB and dioxin contamination on the northwest portion of the site has not been conclusively determined. A likely source is a tank owned by Bliss Waste Oil of Missouri, which was located on the Clayton Chemical Company property. Bliss Waste Oil had four above-ground storage tanks located in the northern portion of Clayton's property which were used to store waste oil and diesel fuel. In February, 1983, a former employee of Bliss informed IEPA of a leaking underground storage tank owned by Bliss in the area of the other tanks. This tank was apparently used to drain unwanted liquid from the above ground tanks.

IEPA located the underground tank and conducted preliminary sampling an excavated area around the tank. Analysis of these samples detected significant levels of PCBs and other priority pollutant organic compounds. In June, 1983, the underground tank was removed by a contractor for Russell Bliss (the former owner), and additional sampling was done to determine the extent of remaining soil contamination. Liquids and sludges in the tank were containerized, along with contaminated soil from the excavation. All containerized materials were removed to a licensed hazardous waste facility by November, 1983.

Data Assessment and Recommendations

Based on the information outlined above, there is significant and widespread contamination in the area of the Sauget Treatment Plant. Additional information is available from Russell and Axon, Inc., and further attempts should be made to secure all data pertaining to chemical wastes in the area from this contractor. A signifcant amount of analytical data has been generated for the contaminated area west of the treatment plant. However, the horizontal and vertical extent of contamination has not been assessed. Similarly, very little data is available with respect to the former sludge lagoons which would be useful in proposing remedial alteratives.

The present scope of work for this project includes only collecting and cataloging all data pertaining to Site O. Wastes have been characterized in the area west of the treatment plant, and two major contaminants have been identified to a depth of 28 inches in this area. Data is also available from samples taken in the vicinity of the former sludge lagoons which provides an indication of possible waste types present in the lagoons. The approximate boundaries of the lagoons can be determined based on a review of historical aerial photographs. The data generated to date for Site O indicates that further field investigation is warranted. In order to define and specify remedial alternatives, the areas of surface and subsurface soil contamination need to be accurately defined. In addition, since the sludge lagoons are not lined, and may have been excavated into the Henry Formation aquifer, a strong possibility for ground water contamination exists.

For the former sludge lagoons, it is recommended that soil borings be completed into the lagoons to a depth sufficient to assess the vertical migration of contaminants from the lagoons. The borings should be located so as to provide intersecting cross sections for mapping purposes, and should cover the entire lagoon area. Samples should be composited for ten foot intervals for each boring and analyzed for all hazard substance list (HSL) compounds. These

borings and samples would provide adequate characaterization of the chemical constituents present in the lagoons and provide information concerning vertical migration of contaminants. In addition, four deeper borings should be completed around the periphery of the lagoons to determine if, or to what extent, wastes have migrated from the lagoons. Detailed field screening would be done on samples from these borings using a portable gas chromatograph (GC). A geophysical investigation using electromagnetics would be completed in conjunction with these borings to define the lateral extent of any contaminant plume that may be present. If initial borings into the lagoons indicate that ground water monitoring is necessary, the deeper borings around the periphery could be used for monitoring well emplacement.

The identified area of soil contamination west of the treatment plant should be more accurately defined. Recommendations for this area include completing several test borings in the area to determine the maximum depth of contamination, followed by grid sampling to accurately define the contaminated area. Samples collected from the test borings could be extracted and analyzed for PCBs in the field using GC. Since they were found at high concentrations in previous samples, PCBs would be a good indicator for other possible contaminants. Following the determination of the maximum depth of contamination, a detailed sampling program should be developed and conducted in order to define the extent of contamination.

SITE P - SAUGET/MONSANTO LANDFILL

Site Description

Site P is an inactive, IEPA-permitted landfill covering approximately 20 acres in Sauget, Illinois (Figure P-1). The site is bordered on the west by the Illinois Central Gulf Railroad; on the south by Monsanto Avenue, and on the east by the Terminal Railroad Association railroad. The two railroads converge to delineate the north boundary. Generally, the geology at the site consists of silty sand, underlain by fine grained to silty clay, followed by fine to coarse grained sands down to the bedrock. Surface drainage is to the south-central portion of the site, which was not landfilled due to the presence of a potable water line in this area. A depression area is also found along the east perimeter, adjacent to the Terminal Railroad. Surface drainage will not leave the site due to the presence of railroad embankments along the perimeter and the depression in the central portion of the site.

Site History and Previous Investigations

Sauget and Company entered into a lease agreement with the Union Electric Company in St. Louis to operate a waste disposal facility in 1972. In January 1973, IEPA issued an operating permit to Sauget and Company to accept only non-chemical waste from Monsanto. Sauget and Company subsequently applied for, and was granted, a supplemental permit in 1974 which allowed acceptance of general waste and diatomaceous earth filter cake from Edwin Cooper, Inc. (now Ethyl Corp.). The IEPA began conducting routine inspections of the facility in 1974, at which time no violations were evident. In October 1975, an inspector observed a small amount of yellowish, tar-like liquid in an area adjacent to several crushed fiber drums which were labelled "Monsanto ACL-85, Chlorine Composition." Sauget and Company and Monsanto were subsequently notified of this permit violation, and the matter was not further addressed. The site was operated in general compliance until December 1977, when an

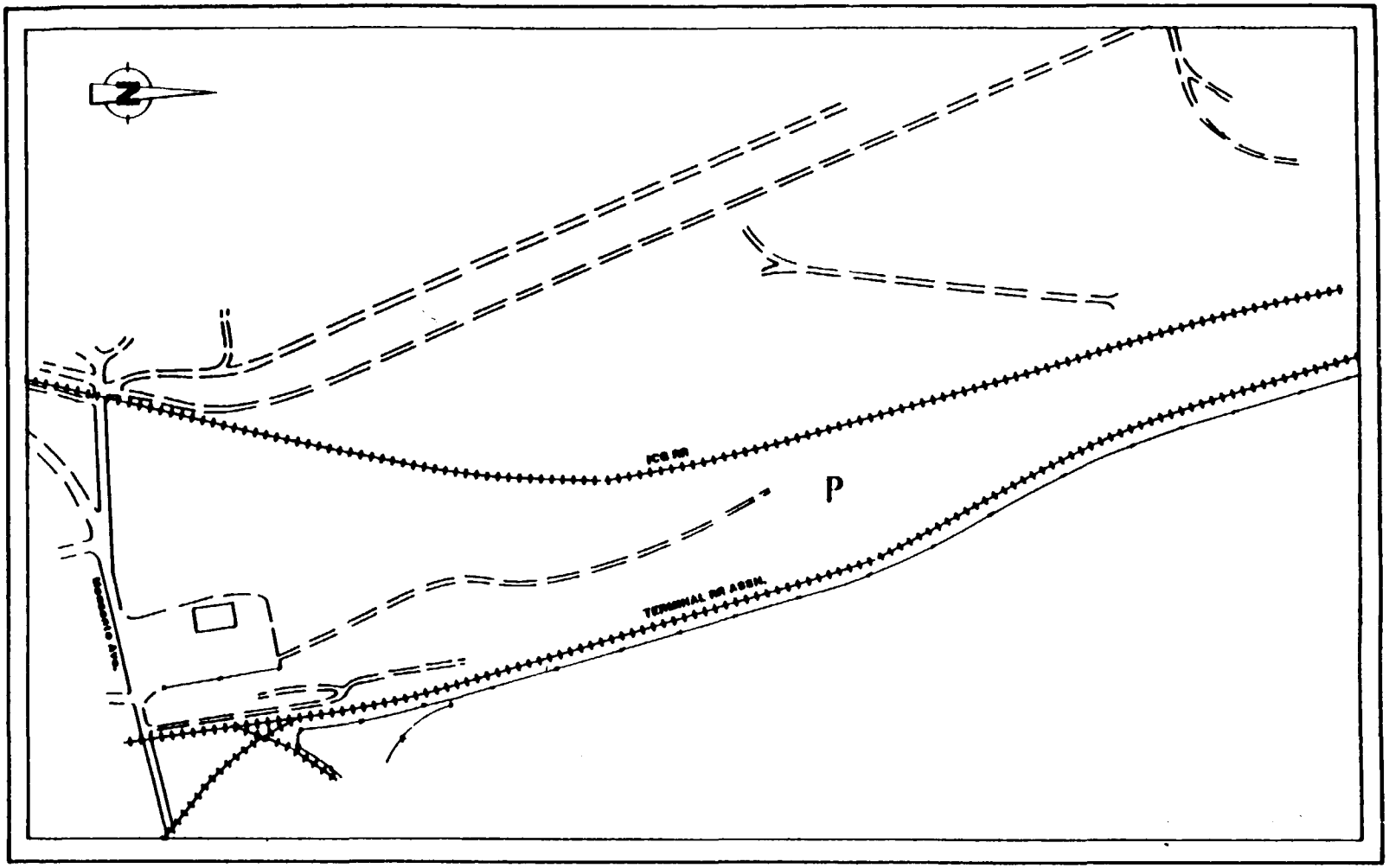


FIGURE P-1
DEAD CREEK SITE AREA P

inspection revealed the disposal of approximately 25 metal containers (12-15 gallon) full of phosphorus pentasulfide (P_2S_5), a flammable solid. Monsanto was required to excavate and remove all of this material from the site, and to discontinue disposal of any chemical wastes or packagings.

The IEPA became aware of another potential problem at this time, specifically the use of a Southern Railway slag pile for intermediate and final cover material. Analysis of this slag showed it to be unsuitable as cover due to its high permeability and heavy metal content. Cinders were also used as cover material at Site P, and are expected to pose the same problems as the slag; that is, increased surface water infiltration and the resulting potential for leaching heavy metals along with organic wastes into the groundwater.

State inspections in 1978 and 1979 indicated unpermitted disposal of Monsanto ACL filter residues and packagings. The composition of this material is not known. According to the site operator at that time, this material would occasionally ignite when in contact with the filter cake waste from Edwin Cooper.

An Illinois American Water Company distribution main was discovered in 1980 during preparatory excavation on the southern portion of the site. The south one-third of the property was purchased from Illinois Central Gulf in 1971 by Paul Sauget. Following discovery of the water line, Site Plans and permits were modified to include no waste disposal within 100 feet of the line.

Review of available IEPA records indicates that the Edwin Cooper filter cake is the only industrial process waste that was reported to have been disposed of at Site P. Records indicate that approximately 117,000 cubic yards of this material was accepted. The filter cake was classified as non-hazardous on special waste authorization permit number 7400017, based on EP toxicity results submitted in 1973. Additional analytical data is available for a filter cake composite sample from Edwin Cooper in 1979 which indicates elevated levels of

lead (18.4 ppm), cadmium (1.8), zinc (7,220 ppm), and a pH of 11.22. No groundwater monitoring program has been established for Site P, nor have wastes at the site been adequately characterized. No sampling or other field investigation activities have been conducted, other than routine IEPA inspections, at the site.

Data Assessment and Recommendations

A groundwater study consisting of installation and sampling of 6 wells is the only planned field investigation for Site P during the Dead Creek Project. Additional investigation will be necessary to adequately characterize the site and to provide an adequate data base for conducting the feasibility study if groundwater contamination is detected. Further evaluation of subsurface soil conditions at the site would be necessary in order to define waste characteristics and the vertical and lateral extent of contamination so that remedial alternatives can be assessed.

SITE Q - SAUGET/SAUGET LANDFILL

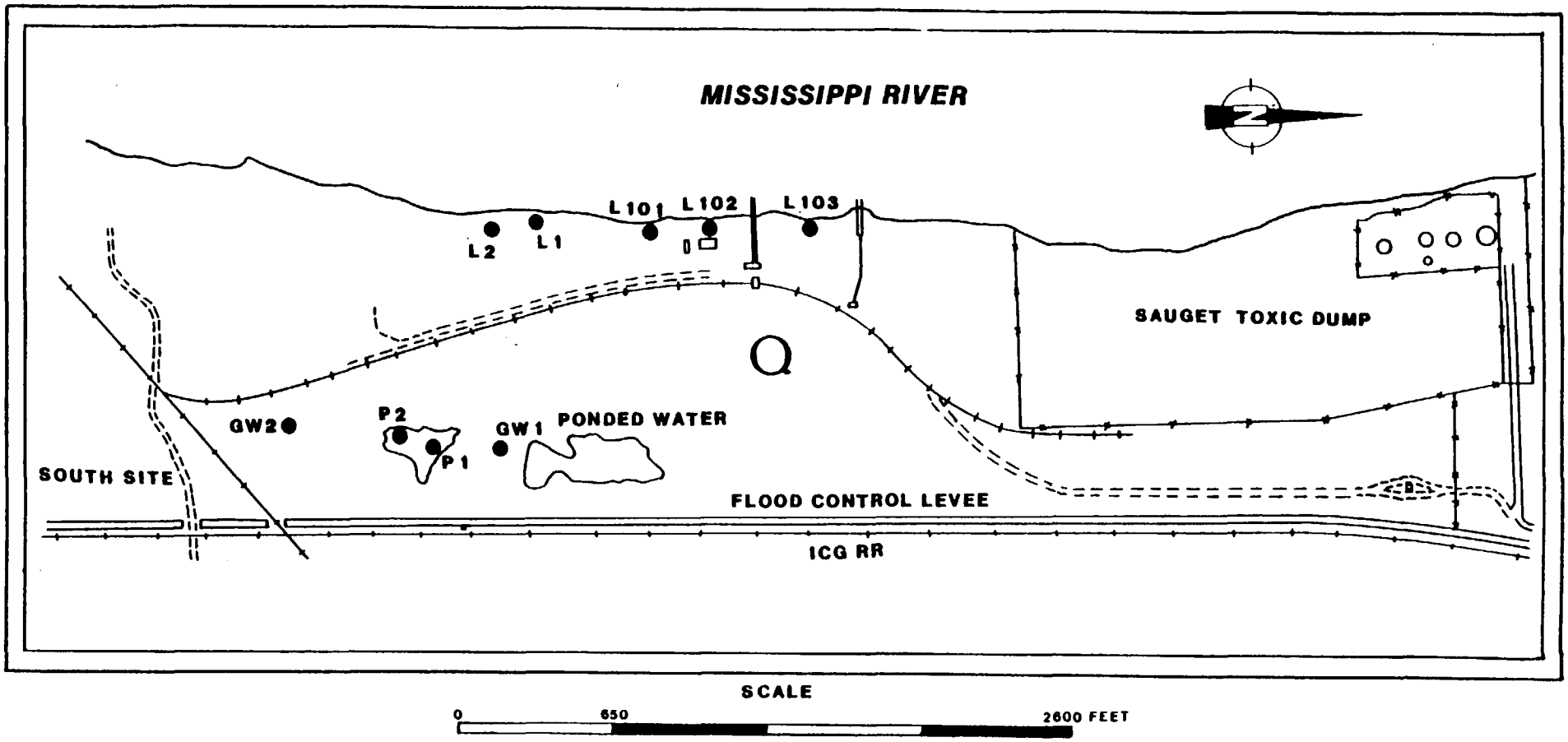
Site Description

Site Q is the Sauget/Sauget Landfill, an inactive waste disposal facility operated by Sauget and Company between the years 1966 and 1973. The site is approximately 90 acres in size, including a southern extension, as delineated by the Alton and Southern Railroad tracks (Figure Q-1). The site is located on east bank of the Mississippi River and is also on the river side of a U.S. Army Corps of Engineers flood control levee. Site Q is also situated immediately east of Site R, commonly known at Sauget Toxic Dump, a chemical waste disposal facility owned by the Monsanto Chemical Company.

Site Q was operated without a permit from IEPA, although registration with the Illinois Department of Public Health was obtained for the north site in 1967, prior to the formation of the IEPA. The site is presently covered with black cinders, which is an unsuitable cover material due to its high permeability. Site Q is presently owned by the Riverport Terminal and Fleeting Company, and the property is leased to the Pillsbury Company. Pillsbury operates a coal unloading facility at the site.

Site History and Previous Investgations

Disposal operations at Site Q began in approximately 1966 in the northernmost portion of the property. A Union Electric Company flyash pond existed at the site in an area immediately south of Monsanto's chemical dump. IEPA inspections in the early 1970's documented several violations of the Illinois Environmental Protection Act, including open burning, use of unsuitable cover materials (cinders and flyash), and acceptance of liquid chemical wastes. Septic tank pumpings were also accepted at the site from approximately 1968 to 1972, and were apparently co-disposed with general municipal refuse.



LEGEND

GW1	IEPA GROUNDWATER SAMPLING LOCATION
P1	IEPA SURFACE WATER SAMPLING LOCATION
L1	IEPA LEACHATE SAMPLING LOCATION

FIGURE Q-1
DEAD CREEK SITE AREA Q WITH SAMPLING LOCATIONS

in April, 1971, a complaint was filed by IEPA against Sauget and Company for the violations mentioned above. The company was ordered to cease and desist open burning, accepting liquid chemical wastes, open dumping, and use of cinders and flyash as cover material. In July, 1972, a smoldering underground fire was observed by IEPA inspectors at the site. The fire continued to smolder until October, 1972 despite repeated attempts to extinguish it. Underground fires were a continuing problem, as documented by later IEPA inspection reports. In the spring of 1973, flood waters from the Mississippi River inundated Site Q. This condition persisted into the fall, and operations at the site were discontinued. Exposed refuse was observed being carried downstream in the river at that time.

Sauget and Company filed a permit application to IEPA in 1972 for a proposed extension to the existing landfill. The proposed extension was located south of the Alton and Southern railroad tracks, and will be referred to as the south site. IEPA denied issuance of a permit for this extension several times, as Sauget and Company had filed repeated applications. Although approval of the south site was never issued, disposal operations continued in this area.

In the early 1970's, IEPA collected several samples from Site Q. Approximate sample locations are shown in Figure Q-1. Analytical data for samples collected from ponded water, leachate seeps, and ground water are provided in Table Q-1. The first set of samples, collected in October, 1972, consisted of one sample from ponded water, and one leachate sample. The results for these samples show the presence of several metals, including copper, iron, lead, mercury, and zinc. Ground water samples were collected in January, 1973 from two monitoring wells at Site Q. Information regarding construction details for these wells has not been located. Sample GW-1 showed trace levels of cadmium, silver, and phenols, while GW-2 showed very little evidence of contamination. Samples were again collected by IEPA from ponded water at Site Q on two occasions in April, 1973. Analytical results showed low levels of boron, cadmium, copper, iron, lead, manganese, mercury, nickel, and zinc in sample

TABLE Q-1: ANALYSIS OF SURFACE AND GROUND WATER SAMPLES COLLECTED BY IEPA AT SITE Q

	SAMPLE LOCATIONS AND DATES					
	10/17/72		1-17-73		4-10-73	4-26-73
PARAMETERS	P-1	L-1	GW-1	GW-2	P-2	P-3
Calcium	80	56	310	137	250	280
Magnesium	8	26	57	205	42	44
Sodium	23	169	275	13	230	205
Potassium	6	30	10	4	85	70
Ammonia	0.19	21	NA	NA	32	36
Boron	7	6.5	NA	NA	2.6	2.8
Cadmium			0.02		NA	0.02
Chromium (Total)					NA	0.03
Copper		0.01			0.02	
Iron		46			60	67
Lead		0.02			0.07	0.07
Manganese					6	6.5
Mercury (ppb)	0.5	0.5			0.4	0.6
Nickel					0.3	0.2
Silver			0.01			
Zinc		0.2		0.1	4.2	5
Alkalinity	46	810	645	375	420	
Chloride	19	4	310	24	210	205
Nitrate	NA	NA	NA	NA	NA	
Phosphate	NA	NA	NA	NA	3.7	5
Sulfate	230	18	325	25	350	270
Hardness	240	560	NA	NA	970	930
Phenols	NA	NA	0.02		NA	NA

NOTE: All results in ppm unless noted otherwise.
Blanks indicate below detection limit.
NA indicated parameter not analyzed.
P = Ponded water, L = Leachate, GW = Groundwater

P-2 and/or P-3. Although the data from samples collected in the early 1970's showed the presence of several contaminants, most notably phenol and heavy metals, no conclusive evidence of contamination at Site Q was obtained.

IEPA collected samples from leachate seeps along the Mississippi River in October, 1981 and again in September, 1983. The locations of these samples are shown in Figure Q-1, and analytical results are presented in Table Q-2. Data for the 1981 samples shows elevated concentrations of arsenic, chromium, copper, lead, managanese, and phosphorus in both samples. Additionally, low levels of phenols and PCBs were detected in the samples. The samples collected in September, 1983 show very similar results. Heavy metals and PCBs were again detected at concentrations very close to those seen in the earlier samples.

The cinders and flyash used as cover materials at Site Q have been the subject of numerous investigations and complaints by IEPA. In addition, the depth of final cover has been deemed inadequate, and enforcement action is pending on this matter. The Illinois Pollution Control Board Case Number 77-84 was filed against Sauget and Company and Paul Sauget in May, 1977. As a result of the findings in this case, a monetary penalty was invoked, and Sauget and Company was ordered to place two feet of suitable cover material on the entire site by February, 1981. Sauget's failure to comply with these orders led the Illinois Attorney General's office to file a similar case. Site Q has been a chronic enforcement problem, and recently Paul Sauget was found in contempt of court for failure to comply with court orders.

Laboratory tests run on the cinders and flyash indicate permeability values in the range of 9×10^{-3} centimeters per second, which is considered unsuitable by IEPA. In addition, metals analysis of the cover material showed unacceptably high levels of arsenic, copper, lead, and zinc. In 1972, IEPA collected samples from stockpiled flyash at Site Q, and ran leach tests for inorganic constituents.

TABLE Q-2: ANALYSIS OF LEACHATE SAMPLES FROM SITE Q (COLLECTED OCTOBER 28, 1981 AND SEPTEMBER 29, 1983 BY IEPA)

	SAMPLE LOCATIONS AND DATES				
	10-28-81		9-29-83		
PARAMETERS	L-1	L-2	L101	L012	L103
Alkalinity	255	293	191	158	242
Ammonia	3.8	2.8	6.5	4	3.7
Arsenic	0.057	0.022	0.11	0.034	0.012
Barium	0.8	0.2	0.5	0.4	0.3
Boron	5.8	5.6	37.5	42	23
Cadmium					
COD	445	35	87	94	71
Chloride	15	17	23	22	31
Chromium (Total)	0.08		0.03	0.01	
Copper	0.2	0.04	1.2	0.06	
Cyanide				0.01	0.01
Hardness	1330	1220	1225	1360	1045
Iron	207	17.5	86	36	6.4
Lead	0.26		0.13	0.08	0.02
Magnesium	145	67	81	73	44.5
Manganese	7.7	34	6.7	6.8	2.7
Mercury					
Nickel	0.3		0.1	0.1	
Nitrate	0.24	0.4	0.21	6.1	1.8
Phosphorus	6.1	0.74	3.1	1.3	0.86
Potassium	16.5	9.5	13.4	13.5	17
R.O.E.	1980	1829	1880	2118	1563
Silver	0.02	0.01	0.01		
Sodium	55.7	53.3	56	70	51
Sulfate	1196	1059	1200	1350	900
Zinc	1.2	0.2	0.3	0.2	
Phenol	0.005	0.005			
PCBs (PPB)	0.7	1	0.5		0.1
2,3-D(PPB)					

NOTE: All results in ppm unless noted otherwise.
Blanks indicate below detection limits.

Samples were taken from piles estimated to be 5 years old, 1 year old, and fresh material to determine the types and quantities of contaminants being leached from this material at the site. Analytical data for these samples are shown in Table Q-3. Analysis of the first set of samples (August, 1972) shows a distinct trend of the more soluble compounds, such as calcium, sodium and potassium, being leached from the fresh ash. However, the second set of samples, collected in October 1972, does not show a similar trend. The reasons for this discrepancy are not clear. The data in Table Q-3 also shows that significant quantities of metals are contained in the ash, particularly for the material estimated to be five years old.

could it be due to amt. of precip. & time of precip?

IEPA's Notices of Violations concerning disposal of chemical wastes at Site Q in early inspections are supported by more recent information. Notification of Hazardous Waste Site Forms were submitted to USEPA from three companies for this site. These notifications indicate disposal of organics, inorganics, solvents, pesticides, paint sludges, and unknown wastes at the site. In May, 1980 workers uncovered buried drums and unknown wastes while excavating for construction of a railroad spur on the property. Workers observed a haze or smoke rising from the material after it was uncovered, suggesting corrosive and/or reactive properties.

In November, 1985, IEPA received a sketch from a reporter for a St. Louis newspaper indicating the location of buried drums containing PCBs. The reporter's source of this information is not known, nor has the information been verified to date.

As a result of the May, 1980 incident in which buried drums were unearthed, USEPA tasked its FIT contractor (Ecology and Environment, Inc.) to perform a detailed study to determine the extent of chemical contamination at Site Q. The study included a systematic geophysical investigation using EM, magnetometry, and ground penetrating radar (GPR), followed by a drilling and sampling program to investigate possible subsurface contamination. The investigation was limited

TABLE Q-3: ANALYSIS OF FLYASH USED AS COVER FROM STOCKPILES AT SITE Q (SAMPLED BY IEPA IN 1972)

PARAMETERS	SAMPLE NUMBERS AND DATES					
	8/3/72			10/16/72		
	5 Years	1 Year	Fresh	5 Years	1 Year	Fresh
Calcium	125	245	285	580	120	130
Magnesium	4.6	6.4	0.5	9	2	
Sodium	10	7.5	58	140	1.3	36
Potassium	7	11	79	56	2	45
Ammonia	1.8	0.36	0.47	0.75	0.05	0.15
Arsenic	NA	NA	NA			0.02
Barium	0.1		0.1			
Boron	0.9	3.6	1.8	1.3	0.6	2.4
Cadmium	0.01	0.01	0.02	0.02		
Chromium				0.03		
Copper	0.09	0.01	0.01	0.06		
Iron	1.3	0.1		0.85	0.1	
Lead	0.03			0.02	0.01	0.02
Manganese	0.69	0.03	0.03	0.75		
Mercury (ppb)	6			6.2		
Nickel	0.1	0.1	0.2	0.12	0.05	0.05
Silver	0.005	0.005	0.005			
Zinc	0.8	0.1		1.05	0.05	0.02
Alkalinity	140	65	120	120	80	135
Chloride	10	12	60	150	4	49
Flouride	0.2	0.2	0.1	0.3	0.3	0.2
Phosphate	NA	NA	NA	1.6	0.07	0.05
Sulfate	290	950	1300	1600	250	270
Hardness	420	1000	1400	1600	340	350
COD	250	33	52	460	26	45

NOTE: All results in ppm unless noted otherwise.
Blanks indicate below detection limit.
NA indicates parameter not analyzed.

to the northern portion of the site which amounts to approximately 25 percent of the site area.

Technos, Inc. of Miami, Florida was contracted to perform the geophysical investigation. This investigation was completed in June 1983. Results of the geophysical investigation identified the probable limits of landfilling and burial zones of relatively large concentrations of iron bearing materials such as drums or car bodies. These iron bearing zones were found in several distinct locations in the north-central and western portions of the study area.

Following the geophysical investigation, a drilling/sampling program was conducted to determine if subsurface soils were contaminated. The program consisted of drilling 18 test borings through the landfill, and collecting 35 soil samples for full priority pollutant analysis, as designated by USEPA. Subsurface soil samples were collected at depths ranging from 10 to 26 feet. Sample locations are shown in Figure Q-2. Analytical data for the soil samples are shown in Table Q-4, which consists of five pages. As can be seen in the table, a wide variety of organic compounds were detected at high concentrations in these samples. The sample analysis consisted of testing for 112 organic compounds, and 63 compounds were confirmed to be present in the subsurface samples.

Specifically, the data showed that thirty-four organic compounds were found at concentrations of 10 ppm or greater. Of these 34 compounds, 20 compounds were detected at concentrations 100 ppm or greater. And of these 20 compounds, 7 compounds were detected at concentrations of 1000 ppm or greater. Compounds detected at concentrations of 1000 ppm or greater include 2,4-dichlorophenol, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, bis(2-ethylhexyl) phthalate, toluene, o-xylene, and PCB-1260. In addition, 2,3,7,8-TCDD was detected in two samples (B4B and B8B). Compounds detected in samples taken from Site Q include many of the same compounds as detected in samples taken from Site R, the Sauget Toxic Dump site. Contamination was detected

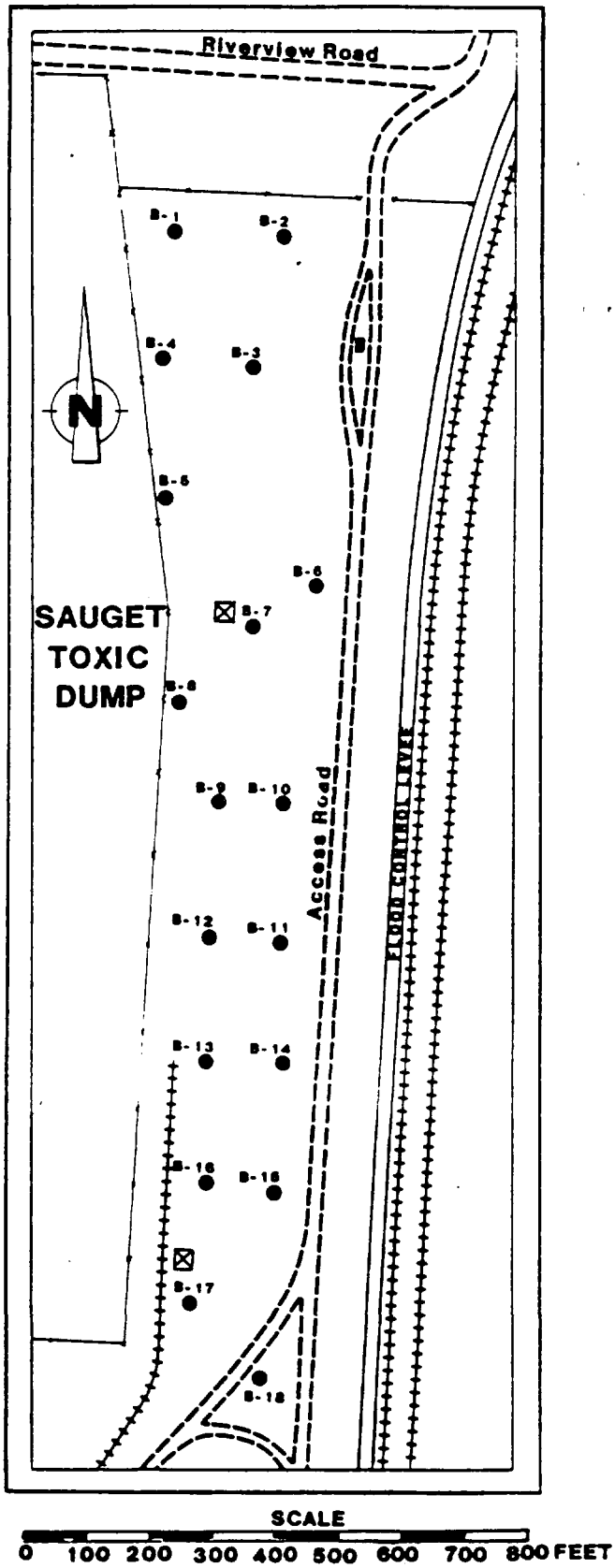


FIGURE Q-2
USEPA - FIT SUBSURFACE SOIL SAMPLING LOCATIONS AT SITE Q

TABLE Q-4: IDENTIFIED ORGANIC COMPOUNDS IN SUBSURFACE SOIL SAMPLES FROM SITE Q (SAMPLES COLLECTED JULY 13, THROUGH JULY 20, 1983 BY ECOLOGY AND ENVIRONMENT, INC.)

	BORING/SAMPLE NUMBER / DEPTH (in feet)							
PARAMETERS	B1A 10.0-11.5	B1B 17.5-19.0	B2A 13.5-15.5	B2B 17.0-19.0	B3A 10.0-12.0	B3B 13.5-15.5	B4A 10.0-12.0	B4B 13.5-15.5
2,3,7,8-TCDD								3.31
2,4,6-trichlorophenol	2,500	170,000	22,000	520	1,400	1,500		94,000
2-chlorophenol	24,000	65,000	800		1,500	LT	57,000	360,000
2,4-dichlorophenol	66,000	3,100,000	31,000	1700	760	4,500		370,000
2,4-dimethyphenol			500					72,000
4,6-dinitro-2-methylphenol								
pentachlorophenol		86,000	5,400	LT		11,000		100,000
phenol	24,000	55,000	45,000	4,400	3,200	100,000	98,000	88,000
2-methylphenol-								
4-methylphenol			LT		560	LT		330,000
2,4,5-trichlorophenol				LT				
acenaphthene			1,200	2,800				
1,2,4-trichlorobenzene				480			LT	100,000
1,2-dichlorobenzene	LT		LT			LT		20,000
1,4-dichlorobenzene			1,800	720	LT	760	LT	66,000
fluoranthene				1,200				LT
isophorone								
napthalene			11,000	8,300				LT
nitorbenzene		8,800	400					56,000
N-nitrosodiphenylamine								
bis(2-ethylhexyl)phthalate				LT				62,000
butyl benzyl phthalate								
di-n-butyl phthalate	LT							LT
di-n-octyl phthalate								
diethyl phthalate								
benzo(a)anthracene								
benzo(a)pyrene								
benzo(b)fluoranthene								
benzo(k)fluoranthene								
chrysene				400				
anthracene								
benzo(ghi)perylene								
fluorene			600	3,000				LT
phenanthrene			1,000	2,700				LT
dibenzo(a,h)anthracene								
indeno(1,2,3-cd)phrene								
pyrene			LT	LT				LT
aniline								
4-chloraniline			LT					
dibenzofuran			1,000	3,000				
2-methylnapthalene			2,000	2,300				
3-nitroaniline			4,600					
benzene								
Chlorobenzene							10,000	40,000
1,2-dichloroethene								
1,1-dichloroethene								
1,1,2,2-tetrachloroethene								
1,2-trans-dichloroethene								
ethylbenzene								
methylene chloride			7.4	3.7	LM	8.0		
tetrachloroethene								
toluene								
trichloroethene								
acetone			960			977		LM
2-butanone								
4-methyl-2-pentanone						LT		
styrene								
O-xylene				2.0				5,100
PCB-1242								
PCB1254								
PCB-1248	1,000							
PCB-1260			485.2		69.6			
PCB-1016			2,120.6					
Total PCB							68,000	1,000,000

NOTE: All results in ppb.
LT = Present, but lower than the detection limit for low hazard analyses.
LM = Present, but lower than the detection limit for medium hazard analyses.
P= The sample could not be cleaned up sufficiently to yield TCDD results.
NA = Not analyzed, sample could not be cleaned up sufficiently.
Blank = not detected.

TABLE Q-4 (continued)

PARAMETERS	BORING/SAMPLE NUMBER Depth (in feet) B5A 13.5-15.5	B5B 17.0-19.0	B6A 10.0-12.0	B6B 13.5-15.5	B7A 10.0-12.0	B7B 13.5-15.5	B8A 13.5-15.5	B8B 17.5-19.5
2,3,7,8-TCDD								0.11
2,4,6-trichlorophenol	130,000	26,000	2,700	4,800	2,700		480,000	10,000
2-chlorophenol	31,000	8,400	1,600	1,600	LT			
2,4-dichlorophenol	560,000	260,000	17,000	15,000	6,100		1,500,000	64,000
2,4-dimethyphenol			2,000					
4,6-dinitro-2-methylphenol								
pentachlorophenol				16,000	25,000	31,000		
phenol	140,000	250,000	45,000	11,000	1,800			
2-methylphenol-			1,400	600				
4-methylphenol		36,000	7,000	1,400				
2,4,5-trichlorophenol								
acenaphthene								
1,2,4-trichlorobenzene	86,000	13,000					120,000	
1,2-dichlorobenzene	100,000	28,000	LT				180,000	
1,4-dichlorobenzene			3,100	800				
fluoranthene								
isophorone								
napthalene		LT	800	LT			380,000	LT
nitorbenzene	27,000	11,000	LT				52,000	
N-nitrosodiphenylamine								
bis(2-ethylhexyl)phthalate								
butyl benzyl phthalate								
di-n-butyl phthalate			400	LT				
di-n-octyl phthalate								
diethyl phthalate								
benzo(a)anthracene								
benzo(a)pyrene						LT		
benzo(b)fluoranthene						LT		
benzo(k)fluoranthene						LT		
chrysene						LT		
anthracene								
benzo(ghi)perylene								
fluorene								
phenanthrene								
dibenzo(a,h)anthracene								
indeno(1,2,3-cd)phrene								
pyrene								
aniline								
4-chloraniline			9,000					
dibenzofuran								
2-methylnapthalene								
3-nitroaniline								
benzene						3.2	LM	
Chlorobenzene	18,000	27,000	100,000	8.4		4.2	7,100	
1,2-dichloroethane			12,000	3.4				
1,1-dichloroethane								
1,1,2,2-tetrachloroethene								
1,2-trans-dichloroethene								
ethylbenzene			46,000	3.8		4.5		
methylene chloride				15.0	86.0	45.0	LT	
tetrachloroethene					LT			
toluene			50,000	LT		6.1		
trichloroethene						LT		
acetone				330	200	2,600		
2-butanone				LT	LT	LT		
4-methyl-2-pentanone								
styrene								
O-xylene			140,000	13.0	LT	22.0		
PCB-1242	70,000						1,700	2,700
PCB1254	60,000							
PCB-1248				4,700				
PCB-1260					590	13,000	880	1,500
PCB-1016					2,300	46,000		
Total PCB		66,000						

All results in ppb.
LT = Present, but lower than the detection limit for low hazard analyses.
LM = Present, but lower than the detection limit for medium hazard analyses.
P = The sample could not be cleaned up sufficiently to yield TCDD results.
NA = Not analyzed, sample could not be cleaned up sufficiently.
Blank = Not detected.

TABLE Q-4 (Continued)

PARAMETERS	B9A 15.0-17.0	B9B 17.0-19.0	B10A 17.0-19.0	B10B 19.0-21.0	B11A 17.0-19.0	B11B 19.0-21.0	B12A 17.0-19.0	B12B 19.0-21.0
			BORING/SAMPLE NUMBER DEPTH (in feet)					
2,3,7,8-TCDD			P		P	P		
2,4,6-trichlorophenol	LT	600	48,000	640			4,400	9,400
2-chlorophenol	640	1,100	1,700	LT			1,200	520
2,4-dichlorophenol	7,400	9,800	170,000	9,60	3,200	20,000	8,800	4,200
2,4-dimethyphenol		LT						
4,6-dinitro-2-methylphenol								
pentachlorophenol		4,800		2,200			24,000	920
phenol	7,500	14,000	32,000	11,000	6,200	33,000	17,000	7,500
2-methylphenol-4-methylphenol	1,400	2,300	2,700				1,000	720
2,4,5-trichlorophenol								
acenaphthene								
1,2,4-trichlorobenzene			11,000					
1,2-dichlorobenzene			11,000		LT			800
1,4-dichlorobenzene		LT	27,000		LT			1,000
fluoranthene								
isophorone					17,000	LT		720
naphthalene			6,500		72,000	35,000	LT	640
nitrobenzene								
N-nitrosodiphenylamine						LT	LT	
bis(2-ethylhexyl)phthalate	440				52,000	34,000	440	
butyl benzyl phthalate					LT			
di-n-butyl phthalate		1,500	LT		23,000	LT		
di-n-octyl phthalate								
diethyl phthalate	LT	840						
benzo(a)anthracene								
benzo(a)pyrene								
benzo(b)fluoranthene								1,000
benzo(k)fluoranthene								1,000
chrysene					6,400			
anthracene								
benzo(ghi)perylene								
fluorene								
phenanthrene					5,200			
dibenzo(a,h)anthracene								
indeno(1,2,3-cd)phrene								
pyrene					5,600			
aniline								
4-chloraniline								LT
dibenzofuran								
2-methylnapthalene					10,000			
3-nitroaniline								
benzene			LM					
Chlorobenzene			5,200		LM			
1,2-dichloroethene								
1,1-dichloroethene								
1,1,2,2-tetrachloroethane								
1,2-trans-dichloroethene								
ethylbenzene			6,500		220,000			
methylene chloride	3.3	300	8,700	LT				
tetrachloroethene								
toluene			130,000		1,300,000	100,000		LM
trichloroethene					42,000			
acetone	210	14,000		4,400				
2-butanone								
4-methyl-2-pentanone							LT	
styrene								
O-xylene			30,000		650,000	70,000		LM
PCB-1242	600		NA					
PCB-1254			NA					
PCB-1248			NA		38,000	70,000		
PCB-1260	1,500	1,300	NA	120	45,000	681,000	7,000	5,000
PCB-1016								

All results in ppb.
LT = Present, but lower than the detection limit for low hazard analyses.
LM = Present, but lower than the detection limit for medium hazard analyses.
P = The sample could not be cleaned up sufficiently to yield TCDD results.
NA = Not analyzed, sample could not be cleaned up sufficiently.
Blank = Not detected.

TABLE Q-4 (Continued)

PARAMETERS	BORING/SAMPLE NUMBER Depth (in feet) B13A 17.0-19.0	B13B 19.0-21.0	B14A 17.0-19.0	B14B 19.0-21.0	B15A 22.0-24.0	B15B 24.0-26.0	B16A 22.0-24.0	B17A 22.0-24.0
2,3,7,8-TCDD								
2,4,6-trichlorophenol	20,000	4,600			800	1,900	7,700	6,400
2-chlorophenol	2,500	3,800			600	1,600	4,600	100,000
2,4-dichlorophenol	9,400	11,000	460,000			11,000	27,000	120,000
2,4-dimethyphenol		LT					680	
4,6-dinitro-2-methylphenol	LT							
pentachlorophenol	12,000	44,000	16,000	16.000	4,200	12,000	39,000	26,000
phenol	8,900	15,000			6,000	13,000	16,000	50,000
2-methylphenol-								
4-methylphenol	920	1,400		16,000		1,000	1,900	9,200
2,4,5-trichlorophenol							LT	
acenaphthene								
1,2,4-trichlorobenzene	2,400	3,000	13,000,000	2,000,000				
1,2-dichlorobenzene			620,000	55,000			LT	
1,4-dichlorobenzene	1,300	2,000	1,200,000	100,000		1,600	4,100	
fluoranthene								
isophorone				14,000				
napthalene		LT	210,000	20,000		720	2,000	
nitorbenzene								
N-nitrosodiphenylamine		400						
bis(2-ethylhexyl)phthalate			1,100,000	220,000			4,600	
butyl benzyl phthalate				LT		LT		
di-n-butyl phthalate		LT	900,000	49,000	LT	3,800		
di-n-octyl phthalate		LT						
diethyl phthalate						LT		
benzo(a)anthracene								
benzo(a)pyrene	LT							
benzo(b)fluoranthene	1,300*							
benzo(k)fluoranthene	1,300*							
chrysene								
anthracene								
benzo(ghi)perylene	880							
fluorene								
phenanthrene								
dibenzo(a,h)anthracene	LT							
indeno(1,2,3-cd)phrene	LT							
pyrene								
aniline							680	
4-chloraniline	LT	2,200					9,600	
dibenzofuran								
2-methylnapthalene				LT				
3-nitroaniline								
benzene			44,000					
Chlorobenzene			63,000	LM				
1,2-dichloroethane								
1,1-dichloroethene			19,000					
1,1,2,2-tetrachloroethene			5,700					
1,2-trans-dichloroethene			11,000					
ethylbenzene			790,000	330,000	LT			
methylene chloride	50.0	13.0	5,800		2.5	23.0		LM
tetrachloroethene			12,000					
toluene			2,400,000	540,000				
trichloroethene			55,000					
acetone	90.0	430			540	1,400		
2-butanone			LM					
4-methyl-2-pentanone		LT	250,000		LT			
styrene				64,000	4.2	5.3		
O-xylene			2,300,000	1,400,000		LT		
PCB-1242						5,000		
PCB1254								
PCB-1248								
PCB-1260	770	1,300	2,900,000	16,000,000	190	1,000	370	68.0
PCB-1016					210			
Total PCB								

All results in ppb.
LT = Present, but lower than the detection limit for low hazard analyses.
LM = Present, but lower than the detection limit for medium hazard analyses
P = The sample could not be cleaned up sufficiently to yield TCDD results.
NA = Not analyzed, sample could not be cleaned up sufficiently.
Blank = Not detected.

TABLE Q-4 (Continued)

PARAMETERS	B17B 24.0-26.0	B18A 22.0-24.0	B18B 24.0-26.0	Blank 1	Blank 2	Spike @1.0 ppb	Spike @1.0 ppb
	BORING/SAMPLE NUMBER Depth (in feet)						
2,3,7,8-TCDD						0.37	0.91
2,4,6-trichlorophenol							
2-chlorophenol							
2,4-dichlorophenol	3,800						
2,4-dimethyphenol							
4,6-dinitro-2-methylphenol							
pentachlorophenol							
phenol							
2-methylphenol-							
4-methylphenol							
2,4,5-trichlorophenol							
acenaphthene							
1,2,4-trichlorobenzene							
1,2-dichlorobenzene							
1,4-dichlorobenzene	550		LT				
fluoranthene					1,000		
isophorone							
napthalene							
nitorbenzene							
N-nitrosodiphenylamine							
bis(2-ethylhexyl)phthalate	580	910	1,400	LT			
butyl benzyl phthalate							
di-n-butyl phthalate			LT				
di-n-octyl phthalate		LT					
diethyl phthalate							
benzo(a)anthracene		520			600		
benzo(a)pyrene					LT		
benzo(b)flu		LT			LT		
benzo(k)fluoranthene		LT			LT		
chrysene		640			560		
anthracene							
benzo(ghi)perylene							
fluorene							
phenanthrene					720		
dibenzo(a,h)anthracene							
indeno(1,2,3-cd)phrene							
pyrene		LT			800		
aniline	51,000	1,700					
4-chloraniline		960					
dibenzofuren							
2-methylnapthalene							
3-nitroaniline							
benzene							
Chlorobenzene	4.1						
1,2-dichloroethane							
1,1-dichloroethane							
1,1,2,2-tetrachloroethane							
1,2-trans-dichloroethene							
ethylbenzene	7.7						
methylene chloride	6.1	19.0	47.0	LM	6.9		
tetrachloroethene							
toluene							
trichloroethene							
acetone	2,000		260				
2-butanone							
4-methyl-2-pentanone							
styrene							
O-xylene	23.0						
PCB-1242							
PCB1254							
PCB-1248							
PCB-1260	160		2,400		260		
PCB-1016							
Total PCB		670					

All results in ppb.
LT = Present, but lower than the detection limit for low hazard analyses.
LM = Present, but lower than the detection limit for medium hazard analyses.
P = The sample could ot be cleaned up sufficiently to yield TCDD results.
NA = Not analyzed, sample, could not be cleaned up sufficiently.
Blank = Not detected.

across the entire area investigated, which suggests that disposal of large quantities of chemical wastes occurred specifically in the northern portion of Site Q and probably over the entire site area.

Data Assessment and Recommendations

The data developed to date for Site Q shows significant overall contamination at the site. Leachate samples collected from the west-central portion of the site contained phenols, PCBs, and several metals. Data collected prior to 1980 show general degradation of water quality, as evidenced by the analysis of leachate and pond water samples. The cinders and flyash used as cover material over the entire site have been shown to contain elevated levels of heavy metals, and also to be highly permeable. The subsurface soil investigation conducted in 1983 indicated widespread organic contamination to a depth of 26 feet in the northern portion of Site Q. This study provides the only depth and area-specific information available for the site concerning chemical contamination. Since the 1983 study was limited to approximately 25 percent of the total site area, it is apparent that further investigation is necessary for Site Q.

Field activities presently scheduled at Site Q for the Dead Creek Project include the installation and sampling of seven monitoring wells and ambient air monitoring. This would provide limited information concerning overall site contamination, but would not be adequate to permit a detailed feasibility study of specific remedial options. Further field activities should include additional geophysical investigations and subsurface soil sampling for areas not covered in the 1983 investigation, plus infiltration tests, hydraulic conductivity tests, ground water monitoring, and an assessment of the ground water hydrology in relation to the river.

The proposed geophysical surveys should be conducted in both on- and off-site areas to delineate any off-site migration of contaminant plumes and other possible drum burial areas. Infiltration tests would be conducted at several locations to determine the adequacy of

cover material, and to provide an estimate of leachate production. The ground and surface hydrology should be assessed over a period of time sufficient to address seasonal fluctuations. This assessment would provide data to determine ground water discharge and recharge in relation to the river. Additional investigation, if necessary, would be proposed following the completion of these activities.

SITE R - SAUGET TOXIC DUMP

Site Description

Site R is the Sauget Toxic Dump, an inactive industrial waste landfill used by the Monsanto Chemical Company between the years 1957 and 1977. Site R occupies approximately 36 acres adjacent to the Mississippi River in Sauget, Illinois. The site is located immediately west of Site Q, commonly known as the Sauget Landfill. Site R is presently covered with a clay cap and vegetated, and drainage is directed to ditches around the perimeter of the site. A Monsanto feedstock tank farm is located adjacent to the site on the northwest side.

Site History and Previous Investigation

Site R, also known as the Krummrich Landfill, was operated by Sauget and Company under contract with Monsanto. According to an Eckhardt Report summary sheet submitted in 1979 by Monsanto, approximately 262,500 tons of liquid and solid industrial wastes were disposed of at Site R from Monsanto plants in Sauget and St. Louis. In 1981, Monsanto submitted two Notification of Hazardous Waste Site Forms for Site R to the USEPA. The Monsanto W.G. Krummrich Plant (Sauget) listed 290,000 cubic yards (c.y.) of organics, inorganics, solvents, pesticides, and heavy metals as having been disposed at Site R. The Monsanto J. F. Queeny Plant (St. Louis) listed 6600 c.y. of the same waste types as above. Both notifications also indicated below-ground disposal of drums.

Monsanto has also submitted two reports to IEPA outling waste types and volumes disposed of at Site R for the years 1968 and 1972. Data compiled from these reports are summarized in Table R-1. This tabulation shows that the volume of wastes landfilled in 1972 was significantly lower than that in 1968 This reduction reflects the elimination of several major production operations at Monsanto's Krummrich Plant. By 1975, the majority of chemical waste disposal at

TABLE R-1: A LISTING OF WASTE TYPES AND APPROXIMATE QUANTITIES DEPOSITED AT SITE R AS REPORTED BY MONSANTO

	Approximate Annual Volume (Cubic Yards) 1968	1972
Still Residues		
From Distillation of:		
Nitroaniline and Similar Compounds	1700	94
Cresols, Esters of Phenol		1140
Chlorophenol, Chlorophenol Ether	1070	774
Aniline Derivatives	1300	208
Chlorobenzol	130	13
Nitro Benzene Derivatives	100	1190
Phenol	1020	
Aromatic Caboxylic Acids	1500	
Chlorinated Hydrocarbons		425
By Products		
Mixed Isomers of Nitrochlorobenzene	1700	785
Mixed Isomers of Dichlorophenol	3000	1240
Waste Maleic Anhydride	730	
Waste Chlorobenzenes and Nitrochlorobenzene	120	
Contaminated Acids and Caustic		
Waste Sulfuric Acid with Chloropenol Present	1500	1395
Waste Caustic Soda with Chlorophenol Present	5300	1760
Waste Solvents		
Waste Methanol Contaminated with Mercaptans	600	
Waste Isopropanol (Water and Chlorinated Hydrocarbon)	5500	
Miscellaneous Solvents	1019	
Oily Material	101	
Filter Sludges		
Spent Carbon or Other Filter Media	600	12
Lime Mud from Nitroaniline Production	1000	1195
Gypsum		5600
Obsolete Samples and Sampling Wastes		
Chlorophenols	72	40
Laboratory Samples	208	150
Total	28,270	16,021

NOTE: Blanks indicate waste type not reported.

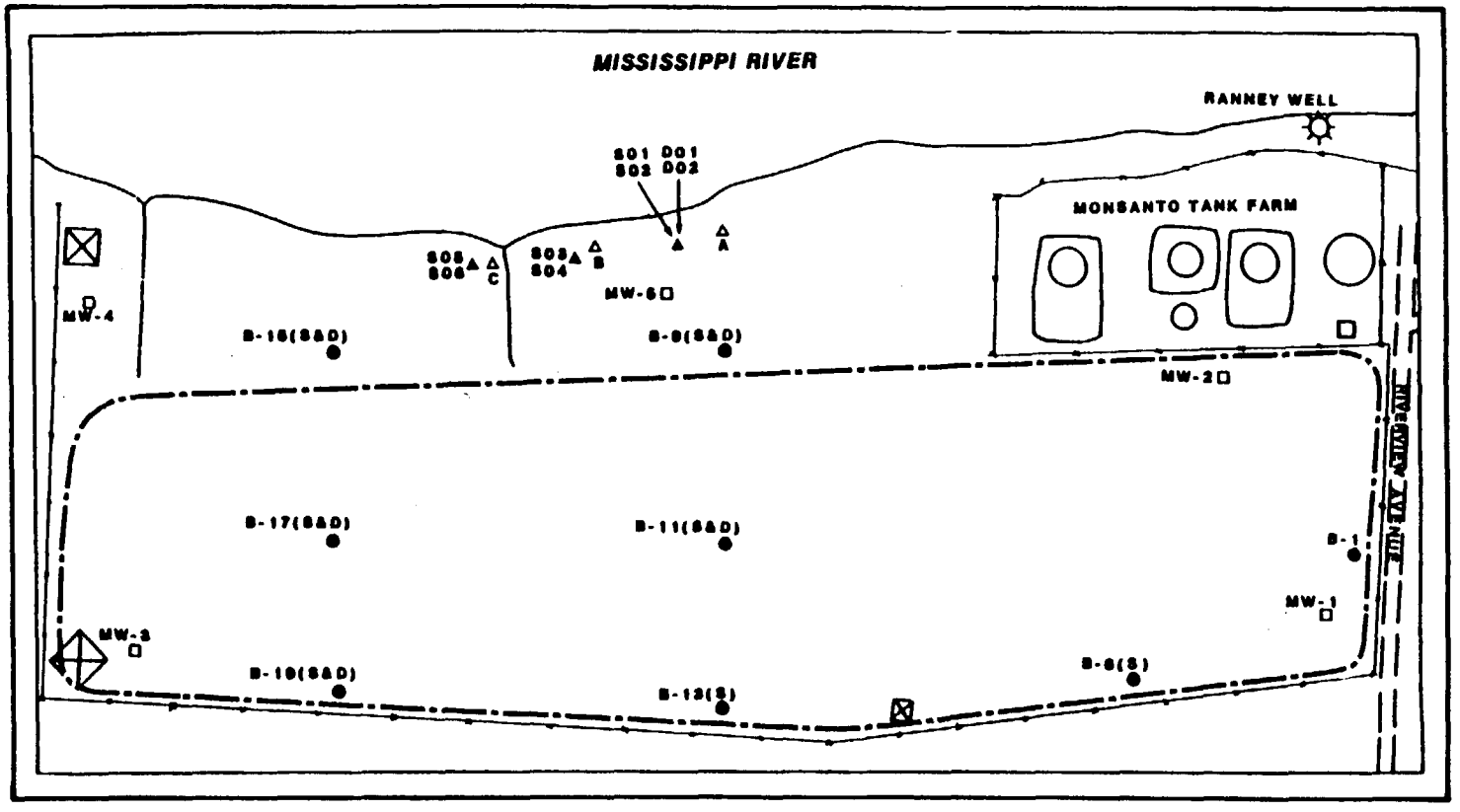
Site R had been terminated, as wastes were either hauled to other disposal facilities or incinerated on the plant site.

Very little information is available concerning disposal activities at Site R prior to 1967. In March, 1967, Sauget and Company filed an application for registration to operate a refuse disposal facility to the Illinois Department of Public Health. Health Department inspection reports from 1967 indicate disposal of liquid chemical wastes and metal containers from Monsanto. Liquids were pumped from tank trucks and drums into several pits around the site. Cinders were used as intermediate cover material.

In August, 1968, the Illinois Department of Public Health collected five ground water samples from on-site monitoring wells. The locations of these wells are shown in Figure R-1, and analytical results are presented in Table R-2. Phenols were detected in all wells at concentrations ranging from 15 to 1220 ppb. Alkalinity and total solids were also analyzed for, but no significant conclusions can be made from the data for these parameters.

IEPA began making routine inspections at Site R in 1971. Photographs of the site at this time suggest that wastes were disposed of in direct contact with the ground water. No segregation of liquid wastes was apparent in these photographs. IEPA collected another set of samples from the monitoring wells in December, 1972. Analytical data for these samples are shown in Table R-3. The results indicate concentrations of iron, zinc, and phenol above the State's water quality standards. Oil was also detected in wells MW-1 and MW-4. Samples were also collected from waste ponds at Site R by IEPA in January, 1973 and analyzed for phenol. Two samples were collected from pits identified as crystallization ponds, and one sample was taken from a spent caustic pond. Results for the waste pond samples are shown in Table R-4. High concentrations of phenols were detected in all samples.

In 1973, IEPA sent notices to Sauget and Company and Monsanto



LEGEND

A	IEPA LEACHATE & SEDIMENT SAMPLING LOCATION
S01	USEPA - FIT LEACHATE & SEDIMENT SAMPLING LOCATION
D01	DUPLICATE SAMPLE
MW-1	IEPA MONITORING WELL SAMPLING LOCATION (PRIOR TO 1979)
B-1	IEPA MONITORING WELL SAMPLING LOCATION (1979-1981)

SCALE
0 100 400 800 FEET

FIGURE R-1
STATE AND USEPA SAMPLING LOCATIONS AT SITE R.

TABLE R-2: ANALYSIS OF GROUND WATER SAMPLES FROM SITE R (COLLECTED AUGUST 22, 1968 BY THE ILLINOIS DEPARTMENT OF PUBLIC HEALTH)

PARAMETERS	SAMPLE LOCATIONS				
	MW-1	MW-3	MW-4	MW-5	MW-6
Total Solids (conductivity mmhos)	320	300	280	250	500
Alkalinity (ppm)	172	148	156	124	248
Phenol (ppb)	1220	25	20	15	1200

TABLE R-3: ANALYSIS OF GROUND WATER SAMPLES FROM SITE R (COLLECTED DECEMBER 5, 1972 By IEPA)

	SAMPLE LOCATIONS			
PARAMETERS	MW-1	MW-2	MW-3	MW-5
Calcium	50.2	147	36	49
Magnesium	15.8	36	18	18.5
Sodium	18.5	112	15	18.5
Potassium	3.6	6.7	4.2	3.5
Ammonia	1.5	2	0.65	0.92
Arsenic				
Boron	0.1	0.7	0.1	0.1
Cadmium				
Chromium (Total)				
Copper		0.1		
Iron	2.4	28.2	1.4	8.5
Lead				0. 02
Manganese	0.35	0.61	0.12	0.95
Mercury				
Nickel				
Zinc	0.40	1.42	0.21	2.05
Alkalinity	180	430	145	185
Chloride	22	225	22	22
Fluoride	0.2	0.2	0.2	2
Nitrate	0.1	0.3	0.1	0.1
Phosphate	0.003	0.21	0.05	0.34
Sulfate	16	12	29	32
Conductivity (mmhos)	445	1400	390	470
Phenols	0.088	0.2	0.007	0.014
Oil	1	0	1	0
Hardness	200	530	170	200
COD	46	135	3	8

NOTE: All results in ppm.
Blanks indicate below detection limits.

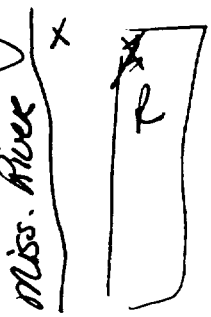
TABLE R-4: ANALYSIS OF SURFACE WATER SAMPLES FROM WASTE PONDS AT SITE R (COLLECTED JANUARY 18, 1973 BY IEPA)

	SAMPLE LOCATIONS		
PARAMETER	CRYSTALLIZATION POND 221	CRYSTALLIZATION POND 270	SPENT CAUSTIC POND
Phenol	2800	50,000	2,000

NOTE: Results in mg/l (ppm).

outlining violations of the Environmental Protection Act at Site R. Violations noted included inadequate segregation of wastes, open dumping of chemical wastes, and operation of a disposal facility without the necessary permits. In addition, it was noted that the cinders being used as cover material was not in accordance with the Rules and Regulations set forth by the Illinois Pollution Control Board. These violations were reiterated several times in 1973 and 1974.

The monitoring wells at Site R were sampled annually between the years 1973 and 1976. In addition to the monitoring wells on site, a Monsanto production well (Ranney Well), located in the northwest corner, was also sampled. Results from these sampling efforts are summarized in Tables R-5 through R-8. Although specific pumping data for the Ranney Well could not be located, Illinois State Water Survey reports and file information suggests that pumpage of the well produced a significant cone of influence in the area. Sample data shows significant contamination in the Ranney Well, most notably with phenols and PCBs. COD, which is a non-specific indicator of organic contaminants, was also detected at much higher concentrations in the Ranney Well than in other wells sampled. Iron, mercury, and zinc exceeded water quality standards on one or more occasion during this time period. It should be noted that analysis of samples collected at Site R prior to 1976 was limited to inorganic parameters and phenols. Ground water samples collected in February, 1976 were analyzed for PCBs (Table R-8). The Ranney well was the only well to show a detectable concentration of PCBs (7.7 ppb).



IEPA monthly inspection reports from 1975 indicate a significant reduction in the volume of chemical waste disposal at Site R. Wastes were being shipped to other locations for disposal or were being incinerated at Monsanto's Krummrich Plant. Monsanto voluntarily ceased disposal operations at the site in 1977 and began closure proceedings. D'Appolonia Consulting Engineers, Inc. (D'Appolonia) was contracted by Monsanto to conduct a subsurface investigation of the site. Twenty soil borings were drilled and eight monitoring

TABLE R-5: ANALYSIS OF GROUNDWATER SAMPLES FROM SITE R (COLLECTED FEBRUARY 22, 1973 BY IEPA)

	SAMPLE LOCATIONS				
PARAMETERS	MW-1	MW-2	MW-4	MW-5	RANNEY WELL
Iron	6.8	11	0.8	6.6	1.9
Manganese	0.35	0.55	0.05	1.05	0.92
Mercury (ppb)	0.4			0.2	
Zinc	1.9	0.6		1.5	
Ammonia	1.6	2.6	0.7	1.3	0.98
Phenol (ppb)	150	80			7500
BOD	31	48	1	1	85
COD	51	78	16	13	220

NOTE: All results in ppm unless noted otherwise.
Blanks indicate below detection limits.

TABLE R-6: ANALYSIS OF GROUND WATER SAMPLES FROM SITE R (COLLECTED MAY 6, 1974 BY IEPA)

	SAMPLE LOCATIONS					
PARAMETERS	MW-1	MW-2	MW-3	MW-4	MW-5	Ranney Well
Arsenic	0.001	0.001	0.005		0.001	0.002
Barium	0.1	0.3	0.2	0.1	0.2	0.2
Boron	0.3	0.9	8.4	0.2	0.1	
Cadmium		0.02				
COD	44	990	21	14	17	340
Chloride	90	215	30	17	16	25
Cyanide		0.008				0.005
Iron	15	43.2	11.9	2.71	7.5	2.65
Lead	0.008	0.01		0.008	0.014	0.95
Manganese	0.69	1.4	1.1	0.2	0.9	0.95
Nitrate						0.4
Oil	4	7	1			5
Phenols	0.35	120	0.1	0.02	0.1	15
R.O.E.	720	1600	750	270	240	820
Selenium						
Sulfate	220	78	305	48	41	31

NOTE: All results in ppm.
Blanks indicate below detection limits.

TABLE R-7: ANALYSIS OF GROUND WATER SAMPLES FROM SITE R (COLLECTED OCTOBER 28, 1975 BY IEPA).

	SAMPLE LOCATIONS			
PARAMETERS	RANNEY WELL	MW-2	MW-4	MW-5
Ammonia				
Arsenic	0.002		0.002	
Barium	0.1	0.1	0.1	0.2
Boron	0.7	0.9	0.5	0.2
Cadmium				
COD	345	210	12	16
Chloride	110	200	23	20
Cyanide		0.02	0.01	
Iron	4.5	13.4	1.45	11
Lead	0.02		0.01	0.04
Manganese	1.3	0.2	0.1	0.7
Nitrate		0.3	0.2	0.1
Oil	3	6	2	3
Phenol	19	1.1	0.025	0.013
R.O.E.	300	920	230	200
Selenium	0.02			
Sulfate	95	6	22	15

NOTE: All results in mg/l, (ppm).
Blanks indicate not detected.

TABLE R-8: ANALYSIS OF GROUNDWATER SAMPLES FROM SITE R (COLLECTED FEBRUARY 17, 1976 BY IEPA)

	SAMPLE LOCATIONS					
PARAMETERS	MW-1	MW-2	MW-3	MW-4	MW-5	RANNEY WELL
Arsenic						0.001
Barium				0.2	0.3	0.1
Boron	0.3	0.8	8	0.5	0.1	1.4
Cadmium						
COD	28	130	8	16	15	390
Chloride	60	410	65	35	35	250
Cyanide	0.01	0.01	0.01	0.01	0.01	0.01
Iron	5.1	19.5	4.3	0.7	7.1	4.6
Lead	0.01	0.02			0.02	
Manganese	0.27	0.27	0.1	0.1	0.85	1.45
Nitrate	0.8	0.1				0.3
Phenols	0.03	0.01				
ROE	370	890	260	220	260	900
Selenium						
Sulfate	110	20	100	44	36	180
PCBs (ppb)						7.7

NOTE: All results in mg/1 (ppm) unless noted otherwise.
Blanks indicate below detection limits.

wells were installed. The D'Appolonia study concluded that the landfill area consisted of 5 to 20 feet of flyash, cinders, silty clay, and unidentified waste. The landfill is underlain by alluvium, consisting of fine sands, silt, and clay ranging in thickness from 5 to 50 feet. Field permeability tests showed that alluvium is fairly permeable (1×10^{-3} cm/sec) suggesting that silty sand is the major component of the alluvium. This finding is supported by the evidence of vertical migration of contaminants to a depth of 65 feet, as suggested in the boring logs. Water levels were generally 25 to 30 feet below ground surface.

In May, 1978, Monsanto filed closure documents to IEPA detailing a closure plan for the site. In general, the plan consisted of specifications for the installation of a drainage system and clay cap, along with details for grading, seeding, and access restriction. The Helmkamp Construction Company was retained to implement the closure plan. An IEPA inspection report from October, 1979 indicated that closure operations at Site R were complete, including installation of a clay cap 3 to 6 feet in thickness. In February, 1980, Richard Sinise, an Environmental Control Engineer for Monsanto, filed an Affidavit of Closure for Site R.

IEPA personnel collected ground water samples from monitoring wells installed by D'Applonia in October, 1979 (Figure R-1). The samples were analyzed for inorganics and organic parameters reported by Monsanto to have been disposed of at the site. Analytical results for these samples are shown in Table R-9. Analysis showed the presence of several organic contaminants in the wells. Both shallow (25 to 35 feet) and deep (60 to 70 feet) wells were sampled, and chlorotoluene and phenol were found in all wells sampled. Well B-19S, located in the southeast portion of the site, also showed chlorophenol, dichlorobenzene, and diphenyl ether at concentrations ranging from 0.81 to 2.1 ppm. Iron, copper, and zinc exceeded water quality standards in several wells. Another set of samples was

TABLE R-9: ANALYSIS OF GROUNDWATER SAMPLES FROM SITE R (COLLECTED BY IEPA ON OCTOBER 12, 1979)

PARAMETERS	SAMPLE LOCATIONS					
	B-9S	B-9D	B-13D	B-15S	B-17S	B-19S
Inorganics						
Arsenic	0.01	0.004	0.002	0.002	0.002	0.007
Cadmium	0.02		0.01			0.01
Chromium	0.03		0.04			0.03
Copper	1.2	0.32	0.87	0.14	0.42	1.6
Iron	290	100	130	56	110	230
Lead	0.2		0.3		0.1	0.2
Magnesium	31	10	27	83	11	28
Manganese	7.8	1	1.4	1.8	0.99	2.8
Nickel	0.6	0.2	1.9	0.1	0.1	0.2
Zinc	3.3	0.36	3	0.4	0.52	0.87
Organics						
Aliphatic hydrocarbons				*	*	*
Chlorophenol	*	*				0.81
Chlorotoluene	70	40	10	0.34	11	18
Dichlorbenzene						1.6
Diphenylether					0.32	2.1
Phenol	21	56	10	14.3	41.5	22

NOTE: All results in ppm
Blanks indicate below detection limits
* Contaminants present, but not quantified

collected by the IEPA from the D'Appolonia monitoring wells in March, 1981. These samples were analyzed specifically for organic compounds. Analytical data for these samples are shown in Table R-10. Concentrations of organic contaminants were detected in all wells sampled. Chlorobenzene (130 to 3000 ppb) was detected in all wells, while biphenylamine, chlorophenol, dichlorobenzene, and dichlorophenol were seen in five or more wells.

In October, 1981, IEPA collected leachate and sediment samples at Site R from an area adjacent to the Mississippi River. Leachate and sediment samples were collected from three locations where leachate seeps were observed flowing from the landfill into the river. Analytical results for these samples are presented in Table R-11, and locations of the samples are shown in Figure R-1. The three water samples showed contamination with a wide variety of organic compounds. PCBs and chloroaniline were detected in all sediment samples. Other compounds detected in sediment samples included 2,4-dichlorophenoxy-acetic acid (2,4-D), chloronitrobenzene, dichloroaniline, chlorophenol, biphenyl-2-ol, and dichlorophenol. The presence of 2,4-D and chlorinated phenols in these samples suggested that dioxin was also a potential contaminant at the site. The IEPA subsequently requested assistance from USEPA in securing a laboratory to perform dioxin analysis on leachate samples from Site R. In November, 1981 a USEPA contractor (Ecology and Environment, Inc.) collected leachate and sediment samples at three locations adjacent to the river (Figure R-1). A total of eight samples plus three blanks were collected. Dioxin analysis was performed by the Brehm Laboratory at Wright State University. Monsanto obtained split samples and analyzed for chlorinated dibenzo-p-dioxins (CDDs), select organics, and metals. The USEPA samples were analyzed for tetra through octa CDDs and dibenzofurans (CDFs), select organics, and metals. Table R-12 provides an explanation and cross-reference for samples collected by USEPA and Monsanto.

Analytical results for CDDs and CDFs in the USEPA leachate samples

TABLE R-10: ORGANIC ANALYSIS OF GROUNDWATER SAMPLES FROM SITE R
(COLLECTED BY IEPA ON MARCH 25, 1981)

	SAMPLE LOCATIONS								
PARAMETERS	B-1	B-6S	B-9S	B9D	B11S	B-11D	B-15D	B-17D	B-19D
Aliphatic hydrocarbons					4,000				
Biphenylamine	1,800	250			15,000	1,100	1,300	860	660
Chlorobenzene	3,000	130	720	810	1,000	2,800	2,800	650	300
Chlorophenol	6,600	5,300	11,000	12,000	13,000	3,200	3,200		950
Chloronitrobenzene			2,500	1,500					
Dichlorobenzene	2,600				1,000	800	930	420	360
Dichlorophenol	1,100	700				630	2,900	670	
Trichlorophenol								1,200	

NOTE: All results in ug/l (ppb).
Blanks indicate below detection limit.

TABLE: R-11: ANALYSIS OF LEACHATE AND SEDIMENT SAMPLES FROM SITE R
(COLLECTED OCTOBER 2, 1981 BY IEPA)

	SAMPLE LOCATIONS					
PARAMETERS	SAMPLE A (WATER) D022687	SAMPLE B (WATER) D022688	SAMPLE C (WATER) D022689	SOIL SAMPLE A D022690	SOIL SAMPLE B D022692	SOIL SAMPLE C D022692
PCB			2.6	48	150	230
Toluene	11	40	150			
Chlorobenzene	160	390	1,600			
Chloroaniline	24,000	22,000	38,000	1,700	190	6,900
Chloronitrobenzene	21,000	9,600	820		130	
2.4-D	16,000	17,000	7,800	53	(<5)	(<5)
2,4,5-T				(<5)	(<5)	(<5)
Dichloronitrobenzene	740	590	790			
Dichloroaniline	870	820	2,800			190
Chloronitroaniline	84	33				
Nitroaniline	100	23				
Chlorophenol	15,000	30,000	27,000			290
Phenol	22,000	17,000	12,000			
Methylphenol	570	220	110			
Dichlorophenol	32,000	7,200	2,100	40		
Nitrophenol	600					
Biphenyldiol	1,700					
Aniline	550	120	35			
Methylbenzene	180	2,000	140			
Sucponamide						
4-methyl-2-pentanol	26					
2-methyl cyclopentanol	93					
Biphenyl 2-Ol	300	300	280			310
Benzenesulfonamide	76	630				
Dichlorobenzene		110	250			
Benzoic Acid/Derivatives	12,000	6,600	2,000			
Hydroxybenzoic Acid/ Derivatives	12,000					
2,4-D Isomer	38,000	48,000	29,000			
2,4,5-T Isomer	10,000	12,000	6,500			

NOTE: All results in ppb.
Blanks indicate below detection limits.
( ) indicates values are unconfirmed.

TABLE R-12: COMPILATION OF LEACHATE AND SEDIMENT SAMPLES COLLECTED AT SITE R IN NOVEMBER, 1981

STATION NUMBER	USEPA SAMPLE NUMBER[a]	MONSANTO SAMPLE NUMBER	DESCRIPTION
1	S01	M01	Leachate (5% Sediment)
1	D01		Duplicate for S01
1	S02	M02	Sediment
1	D02		Duplicate for S02
2	S03	M03	Leachate (10% Sediment)
2	S04	M04	Sediment
3	S05	M05	Leachate (10% Sediment
3	S06	M06	Sediment
Blank	S07		City of Chicago tap water. Blank for low level analysis.
Blank	R01		City of Chicago tap water. Blank for medium level analysis.
Blank	R01		City of Chicago tap water. Extra blank for low level analysis.

NOTE: Monsanto did not split samples where no number is listed.
a - Samples collected by Ecology and Environment, Inc.

are shown in Table R-13. Tetra- and penta-CDDs and CDFS were not detected in any of the samples. However, higher chlorinated dioxins and furans (hexa through octa isomers) were detected in three of the five samples submitted for analysis. Concentrations of these compounds ranged from 4.5 to 2693 parts per trillion (ppt). The two remaining samples, S07 and R01, were water blanks, and showed no detectable CDDs or CDFs. Monsanto also analyzed samples M01 through M05 for CDDs, and results showed no detectable concentrations of these compounds.

Inorganic data for the leachate and sediment samples from Site R are shown in Tables R-14 and R-15. In general, the leachate samples did not show significant inorganic contamination, although concentrations of chromium, copper, boron and iron exceeded water quality standards in two or more samples. Cyanide was detected in several samples, but was also found in the blank. Therefore, the results for cyanide should be considered unreliable. Data for the sediment samples show more substantial evidence of contamination. Elevated levels of arsenic, chromium, copper, lead, and barium were found in several samples. Identified organic compounds in leachate and sediment samples are listed in Table R-16. Phenol and chlorinated phenols were found in all but one sediment sample (M02) at concentrations ranging from 0.2 to 300 ppb. Leachate samples showed elevated levels of several organic parameters, including chlorinated phenols, chlorinated benzenes, chloroanilines, and 2,4-D. As shown in Table R-16, there is a significant discrepancy in the Monsanto and USEPA data for the sediment samples. The values listed by Monsanto were consistently and substantially higher than USEPA values. This may be explained by the fact that USEPA's samples were initially analyzed as medium hazard samples. Because of the higher detection limits associated with this analysis, no contaminants were initially found. USEPA subsequently decided to rerun the samples at lower detection limits. It is possible that the increased holding time and handling of these samples were instrumental in the reduction of concentrations of contaminants found.

Site R was assessed using USEPAs Hazard Ranking System (HRS) model in

TABLE R-13: ANALYSIS OF TETRA THROUGH OCTACHLORINATED DIBENZO-P-DIOXINS AND DIBENZOFURANS IN LEACHATE SAMPLES FROM SITE R (COLLECTED NOVEMBER 12, 1981 BY ECOLOGY AND ENVIRONMENT, INC.)

SAMPLE LOCATIONS	PARAMETERS									
	TCDDs	TCDFs	PCDDs	PCDFs	HXCDDs	HXCDFs	HPCDDs	HPCDFs	OCDDs	OCDFs
S01					4.5	6.3	86	74	323	30
S03					6.3	10	181	182	675	103
S05					5.8	6.3	152	112	2693	53
S07 (Blank)										
R01 (Blank)										

NOTE: All results in parts per trillion (ppb).
Blanks indicate below detection limits.
Analysis performed by Brehm Laboratory, Wright State University.

TABLE R-14: INORGANIC ANALYSIS OF LEACHATE SAMPLES FROM SITE R (COLLECTED NOVEMBER 12, 1981 BY ECOLOGY AND ENVIRONMENT, INC.)

	SAMPLE LOCATIONS							
PARAMETERS	S01	M01	D01	S03	M03	S05	M05	R01
Arsenic	0.034	0.02	0.031	0.016	0.025	0.029	0.065	
Mercury	0.0002		0.0002	0.0002	0.0014	0.0008	0.001	
Selenium	0.038		0.032	0.026		0.031		
Thallium								
Antimony								
Beryllium		0.008			0.005		0.008	
Cadmium		0.006			0.007		0.008	
Chromium	0.04	0.086	0.02	0.015	0.075	0.02	0.07	0.01
Copper		0.073			0.092		0.08	
Lead	0.005		0.008					
Nickel	0.04	0.155			0.124		0.144	
Silver						0.01		
Zinc	0.048	0.216	0.024	0.01	0.216	0.049	0.062	0.31
Aluminum		26.8			30.5		3.22	
Barium		0.5			0.5		0.36	
Boron	19.7	18	17.1	15.35	13.6	21.6	19.1	
Calcium	N/A	368	N/A	N/A	257	N/A	257	N/A
Cobalt		0.03			0.019		0.031	
Iron	0.06	25.5	0.06		30.8	0.63	27.4	
Magnesium	N/A	43.2	N/A	N/A	48.2	N/A	39.8	N/A
Manganese	0.02	6.27	0.32	1.99	2.1	5.4	8.82	0.03
Molybdenum	N/A	0.53	N/A	N/A	0.403	N/A	0.439	N/A
Phosphorus	N/A	0.9	N/A	N/A	0.907	N/A	2.06	N/A
Sodium	N/A	40.4	N/A	N/A	41.8	N/A	44.2	N/A
Tin						0.02	1.4	
Vanadium		0.18			0.138		0.17	
Cyanide	0.071	N/A	0.057	N/A	N/A	N/A	N/A	0.13

NOTE: All Results in ppm.
Blanks indicate below detection limits.
N/A - Parameter not analyzed.
R01 is a water blank.

TABLE R-15: INORGANIC ANALYSIS OF SEDIMENT SAMPLES FROM SITE R (COLLECTED NOVEMBER 12, 1981 BY ECOLOGY AND ENVIRONMENT, INC.)

	SAMPLE LOCATIONS						
PARAMETERS	S02	S03	M02	S04	M04	S06	M06
Arsenic	1.1	2.9	5.3	1.25	9.6	1.8	8.2
Mercury							
Selenium	1.1	1.8		1.5		1.6	
Thallium							
Antimony				4.0			
Beryllium			0.412		0.489		1.08
Cadmium			0.747	0.61	1.04		2.49
Chromium			10.7		10.4		28.7
Copper			7.17		7.89		25.5
Lead	2.4	2.9		2.45		1.7	
Nickel			17.4		18.6		33.8
Zinc	9.5	10	29.5	6.8	36.3	9.2	69.4
Aluminum	150	190	3870	155	4380	170	13,900
Barium			75.4		130	20	7.79
Boron		25	53	17	28.7	26	30.3
Calcium	N/A	N/A	3660	N/A	4010	N/A	6590
Cobalt			4.7		4.8		9.45
Iron	580	660	5870	425	8660	580	12,600
Magnesium	N/A	N/A	1780	N/A	2090	N/A	4080
Manganese	76	46	79.7	42	119	47	273
Molybdenum	N/A	N/A	10.6	N/A	12.5	N/A	22.4
Phosphorus	N/A	N/A	154	N/A	270	N/A	366
Sodium	N/A	N/A	1840	N/A	1270	N/A	4720
Tin							
Vanadium			14.4		17		43.9
Cyanide	28	13	N/A	6.8	N/A	90	N/A

NOTE: All results in ppm.
Blanks indicate below detection limit.
N/A - Parameter not analyzed.

TABLE R-16: IDENTIFIED ORGANIC COMPOUNDS IN LEACHATE
AND SEDIMENT SAMPLES FROM SITE R
(COLLECTED NOVEMBER 12, 1981 BY ECOLOGY AND ENVIRONMENT, INC.)

	SAMPLE LOCATIONS								
	LEACHATE			SEDIMENT					
PARAMETERS	M01	M03	M05	S02	M02	S04	M04	S06	M06
2-Chlorophenol	340	100		0.26		0.2	200	0.4	
2,4-Dichlorophenol	100					0.42		0.56	
Phenol	130					0.5	300	0.42	300
2,4,6-Trichlorophenol								0.32	
1,4-Dichlorobenzene	30				200		400		600
1,2-Dichlorobenzene	20								
Bis(2 ethylhexyl) Phthalate					400		300		400
Chlorobenzene	160	30							
Aniline	60	40	25						
Chloroanilines	8000	4000	600						
Dichloroanilines	100	40							200
Chloronitrobenzenes	3000	80							
2,4-D	332	100							
PCBs			0.008		0.014		0.034		0.192

NOTE: All results in parts per billion (ppb).
Blanks indicate below detection limit.

July, 1982 by Ecology & Environment, Inc. The final migration score assigned to the site was 7.23, which included observed releases for both the ground water and surface water routes. Route scores for ground water and surface water were 6.12 and 10.91 respectively. The air route was assigned a zero score because an observed release had not been documented. The reason for the relatively low final score for Site R is the lack of a target population, which is a major factor in the HRS model. The source of potable water in the area is an intake in the Mississippi River, located approximately 2.5 miles upstream from the site. The upstream location of the intake excludes it from being used in the model.

In 1982, the Illinois Attorney General's office filed suit (Complaint Number 82-CH-185) against Monsanto outlining several apparent violations of the Illinois Environmental Protection Act. For the most part, the Complaint was directed at alleged water pollution caused by the defendant. Relief requested by the Attorney General included civil penalties and issuance of an injunction directing the defendant to immediately prevent seepage of wastes into the Mississippi River, and to remove all such wastes from the property. To date, no information has been located concerning a determination in this case. The Attorney General's office is presently engaged in an ongoing suit against Monsanto in an attempt to have all wastes removed from the site.

USEPA file information suggests that fish studies have been conducted in the Mississippi River in the vicinity of Site R. The Food and Drug Administration (FDA) in Edwardsville, Illinois has found unacceptable concentrations of PCBs in fish collected downstream of Site R. A detailed study was proposed for the area in the immediate vicinity of the site, however, attempts to obtain data from this study have been unsuccessful to date. It is not known if this study was to have included an assessment of the Sauget Treatment Plant effluent, which is discharged immediately northwest of Site R.

In 1982, USEPA developed a comparative analysis of chemicals

detected in monitoring wells and leachate samples from Site R as they relate to wastes reported by Monsanto to have been disposed of at the site. Also included in the analysis were chemicals reported as being manufactured at Monsanto's Krummrich Plant, as documented in the 1977 chemical inventory developed as a result of the Toxic Substances Control Act (TSCA) and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The analysis revealed a high degree of association or correlation between chemicals detected in the sample, and those reported to have been disposed of or manufactured by Monsanto. A summary of data from this USEPA analysis report is presented in Table R-17.

In 1984, Monsanto contracted Geraghty and Miller, Inc. to perform a detailed hydrogeologic investigation in the Sauget area. Data from this study, which included the installation of approximately 60 monitoring wells, have not been made available.

Data Assessment and Recommendations

A great deal of data has been developed to date for Site R. Organic contaminants have been detected in both shallow and deep monitoring wells on site, as well as in leachate seeps leaving the site. Evidence of contamination has been observed to a depth of approximately 60 feet in soil borings. A substantial listing of the types and quantities of chemical wastes disposed of at the site was submitted to IEPA by Monsanto. In view of this information the only significant data gaps are: (1) specific delineation of contaminant boundaries, and (2) determination of the presence or absence of air emissions from the site. Because of the permeable nature of the subsurface soils and the characteristics of the wastes present at the site, it is likely that extensive migration of contaminants has occurred.

The present scope of work for the Dead Creek Project includes installation and sampling of monitoring wells at Site R. Ambient air monitoring will also be conducted to determine to what extent, if any, off-gassing of organic contaminants is occurring. Every effort

TABLE R-17: COMPARATIVE ANALYSIS OF CHEMICALS DETECTED IN SAMPLES AT SITE R AND THOSE REPORTED TO HAVE BEEN DISPOSED OR MANUFACTURED BY MONSANTO

COMPOUNDS	LEACHATE/SEDIMENT ANALYSIS			GROUNDWATER ANALYSIS	REPORTED DISPOSAL	MANUFACTURED
	IEPA	MONSANTO	USEPA	IEPA	MONSANTO	MONSANTO
PCBs	X	X				X
• Chlorobenzene	X	X		X	X	X
• Dichlorobenzene	X	X		X		X
• Chloroaniline	X	X			X	X
Chloronitrobenzene	X	X		X	X	X
Dichloronitrobenzene	X					
Chlorophenol	X	X	X	X	X	X
Dichlorophenol	X	X	X	X	X	X
2,4-D/Isomers	X	X				X
2,4,5,-T/Isomers	X					X
• Aniline	X	X				
Dichloroaniline	X				X	
Chloronitroaniline	X				X	X
Nitroaniline	X				X	X
• Phenol	X	X	X	X	X	
Nitrophenol	X					
Methylphenol	X					
Diphenyldiol	X					
Benzoic Acid/Derivatives	X				X	X
4-methyl-2-pentanol	X				X	
2-methylcyclopentanol	X				X	
Benzene Sulfonamide	X				X	
Chlorotoluene	X					X
Dioxins/Dibenzofurans			X		X (By Product)	X (By Product)

should be made by th IEPA to obtain data on, and gain access to, the Monsanto wells installed by Geraghty and Miller. Access to these wells would likely eliminate the need for, or at least affect the location of, the monitoring wells to be installed during the field investigation of Site R. Pending the results of ground water sampling, a more specific approach to delineating the extent of contamination could be proposed. Samples should initially be collected from a minimum of 8 wells on Site R, and hydraulic conductivity tests should be run on a minimum of 2 deep and 2 shallow wells. Possibilities for identifying plume characteristics include conducting electromagenetic surveys (including off site areas), and soil gas monitoring. In any event, the lateral and vertical extent of contaminantion must be addressed prior to design of remedial options.